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FORTY NINE GOVERNMENTS

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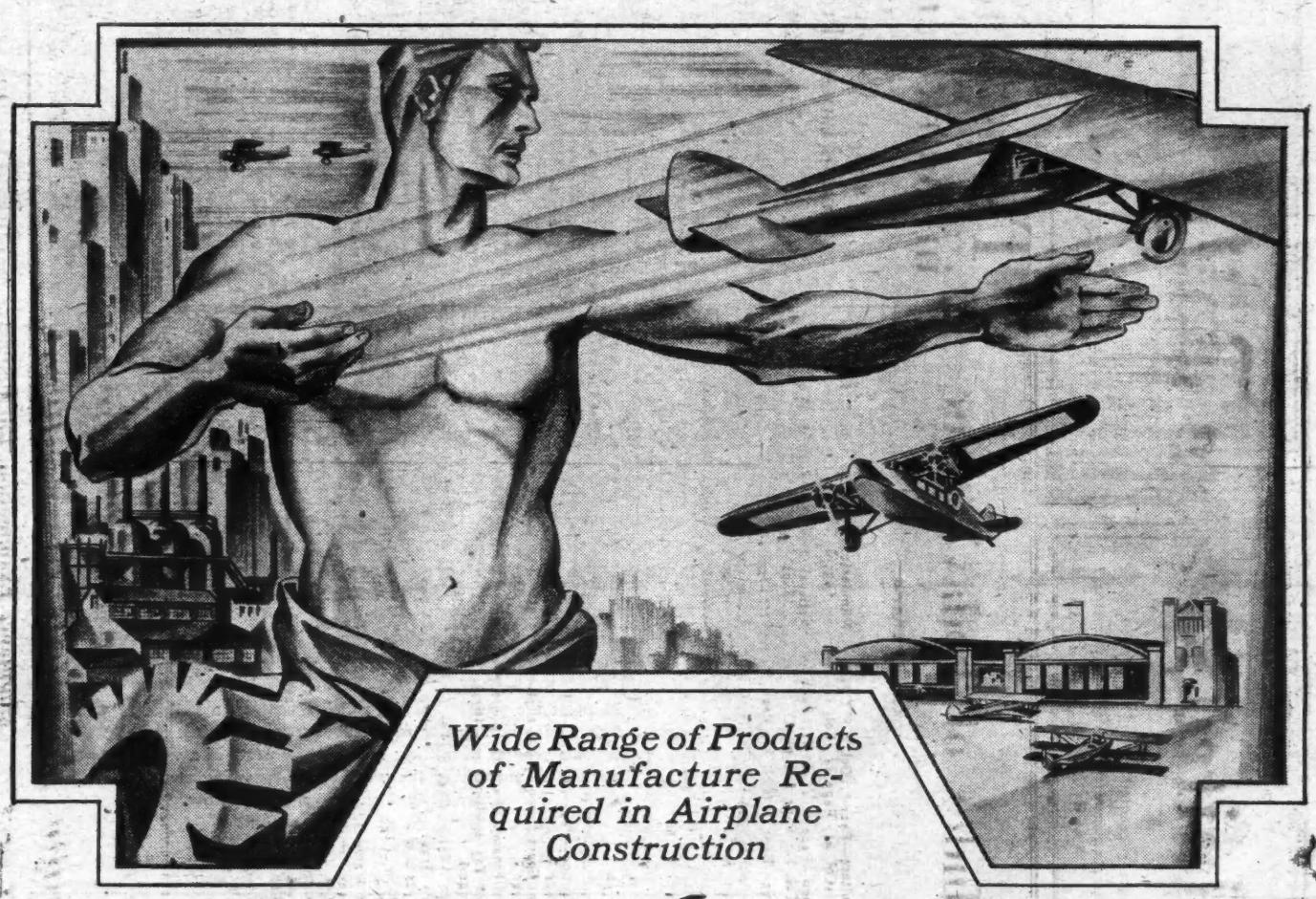
AVIATION AND NATION'S INDUSTRY



Wide Range of Products of Manufacture Required in Airplane Construction

By CLARENCE M. YOUNG
Assistant Secretary of Commerce for Aeronautics

AERONAUTICS has a contact with the Nation's industries which is not generally appreciated beyond the boundaries of airports and the walls of aircraft factories.

Probably because its operations seem so full of flash and romance the aeronautical industry is not often considered as a consumer of the products of scores of other industries.

It has been estimated by various persons in the industry that materials having a total value of at least $50,000,000 were utilized by aircraft manufacturers during 1929, apart from materials used in construction of airports, and that addition of the latter, it is claimed, would probably bring the total for the year up to $100,000,000.

WHILE these figures are impressive, it must be remembered that the industry is not so much a consumer of volume as it is a user of quality, variety and ingenuity. Materials of quality are essential to safety. Operations in three dimensions and over vast areas make the need for wide variety of materials obvious. And the comparative youth of the industry stands as a constant invitation to the exercising of ingenuity in design and production.

On the ground, preparation of fields, construction of hangars, administration buildings and shops, make demands upon the abilities and ingenuities of the construction industry. Services of specialists are required to devise and provide solutions for unusual problems in drainage, airport lighting and similar operations. All the while the genius of architecture must be present, directing activities so that they will be sure to provide facilities to give fullest service.

A review of the work of the Airport Section of the Aeronautics Branch of the Department of Commerce gives complete evidence of the growing relationship between aeronautics and the construction industry.

It is in the construction of aircraft, however, that most of aviation's connections with other industries are centered and, unfortunately, hidden from general view.

Department of Commerce statistics show that on Feb. 22 6,465 airplanes were licensed and 3,232 identified. Each pound of weight found in these airplanes indicates the presence of the product of specialized industrial effort.

Metal tubing, metal sheets, stampings, forgings and cables used in aircraft must meet exacting requirements far beyond those ordinarily placed before the metal-working industries. Steel, copper, aluminum and duralumin, among the metals most generally used in construction of planes, must prove themselves capable of withstanding exhaustive tests to determine tensile strengths and fatigue limits before they are accepted by aeronautics. And the fullest abilities of designers must at all times be directed upon these metal products for the sake of securing the greatest utility in the face of demands for a minimum of weight.

UNITS which enter into the building of internal combustion engines for use in aeronautics likewise must be the products of the best efforts of the industries handling the raw materials on the way from the mines to the place of final fabrication.

The lumber industry has stepped away from the ordinary business of providing two-by-sixes and its other products of long-standing and broad usage, to answer the demand of aviation for woods of extremely light weight which possess marked strength. These woods are not only selected with the greatest care, but are subjected to kiln treatments developed by exhaustive scientific research. Thus a new industry has virtually been created within an old one for the purpose of giving aviation what it needs.

The textile industry ranks high among the providers of materials for construction of aircraft. Here again is witnessed the intensive work of a long-established industry adapting a large portion of its operations to the demands of aeronautics.

Even makers of glue contribute the results of careful research and manufacturing methods.

A NEW industry has virtually been brought into being to supply aviation with the scores of delicate instruments needed for safe and accurate flying and for aeronautical communication.

Included among the instruments especially developed for aviation are: Altimeters, barographs, rate-of-climb indicators, strut thermometers, inclinometers and turn-and-bank indicators, special magnetic compasses, tachometers, air-speed indicators, and instruments for determining engine and oil temperatures, fuel pressures and fuel supply.

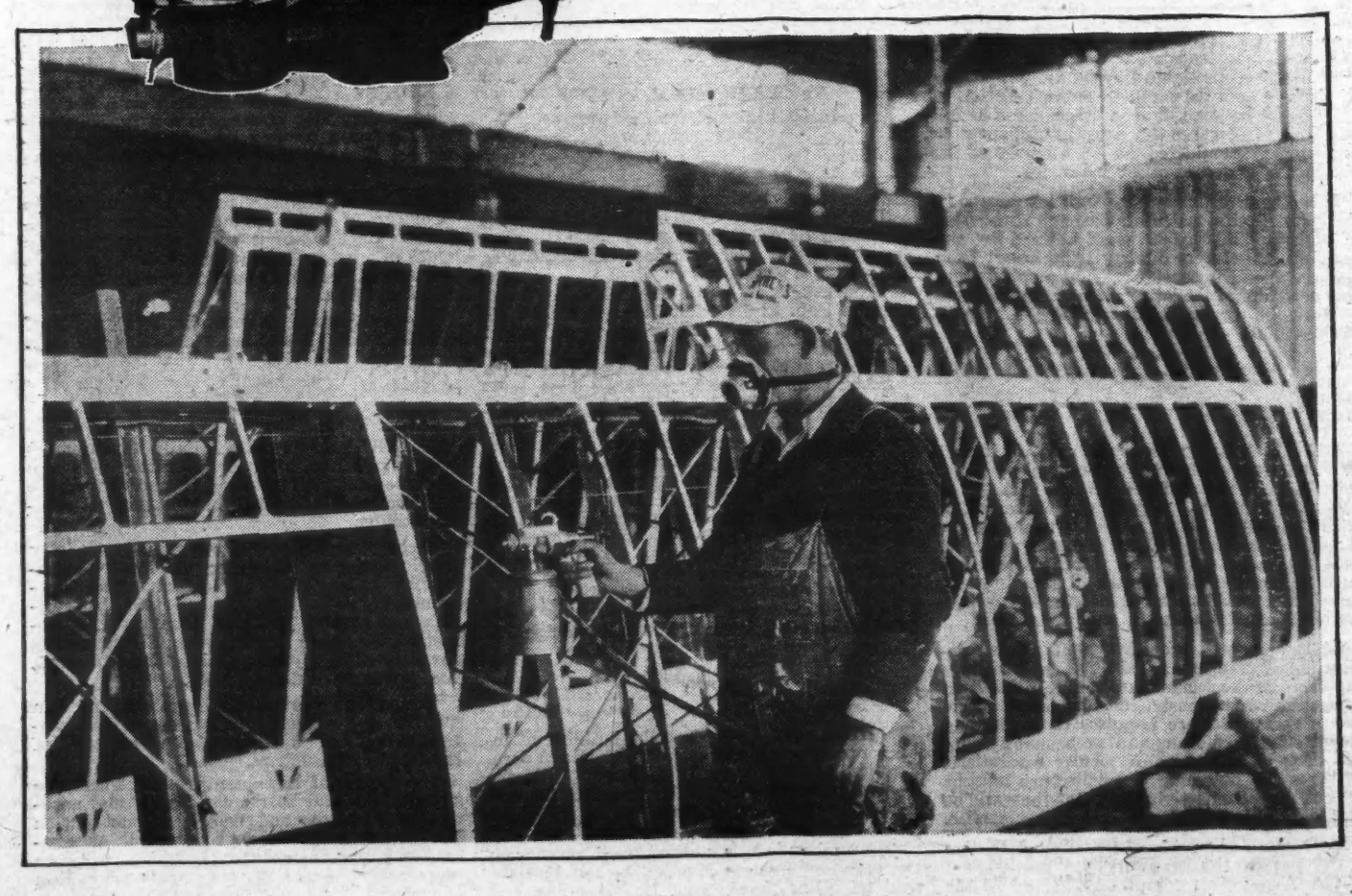
To continue citation of the materials used in aviation and to outline the sources of those materials would virtually involve a "roll call" of the Nation's industries.

The facts that have been presented here are sufficient to lead to the conclusion that aeronautics is broadly and strongly connected with the operations of scores of industries. As aeronautics grows, each of these industries will give increasing time and attention to the production of materials for use in aeronautical operations.

AIR PLANES *in the* MAKING

Painters are putting on the priming coat on a hull of a modern flying boat in the illustration above. On the left is shown the delicate process of putting together the parts of a wing rib. The method of varnishing the woodwork of a wing structure before fabric is put on is illustrated below.

Photographs by Ewing Galloway, New York.



LEGAL ASPECT OF FLYING MISHAPS

Opinion of Attorney General on Policy of Department of Commerce in Aviation Accidents

AN OPINION covering legal phases relating to the policy of the Department of Commerce in connection with aviation accidents has been submitted by the Attorney General, William D. Mitchell, upon the request of the Secretary of Commerce, Robert P. Lamont.

This opinion was presented before the subcommittee of the Senate Committee on Commerce, Mar. 3, by the Assistant Secretary of Commerce for Aeronautics, Clarence M. Young, during hearings on the Bingham bill (S. 3399), to provide for investigations of accidents in civil air navigation.

The Attorney General's opinion follows in full text:

Sir: I have the honor to acknowledge the receipt of the letter of the Acting Secretary, dated Jan. 13, 1930, in which my opinion is asked on the following question arising in the administration of the air commerce act of 1926 (Act of May 20, 1926, c. 344, 44 Stat. 568, U. S. C., Title 49, Sections 171-184):

"Whether Section 2 of the abovementioned act requires the Secretary of Commerce to make public the causes of accident in civil air navigation in any other manner than in statistical form, as outlined in the accompanying papers and at such times as he may deem advisable."

Section 2 of the act reads as follows:

SEC. 2. Promotion of Air Commerce.—It shall be the duty of the Secretary of Commerce to foster air commerce in accordance with the provisions of this act, and for such purpose—

"(a) To encourage the establishment of airports, civil airways, and other air navigation facilities.

"(b) To make recommendations to the Secretary of Agriculture as to necessary meteorological service.

"(c) To study the possibilities for the development of air commerce and the aeronautical industry and trade in the United States and to collect and disseminate information relative thereto and also as regards the existing state of the art.

"(d) To advise with the Bureau of Standards and other agencies in the executive branch of the Government in carrying forward such research and development work as tends to create improved air navigation facilities. The Secretary of Commerce is authorized to transfer funds available for carrying out the purposes of this subdivision to any such agency for carrying forward such research and development work in cooperation with the Department of Commerce.

"(e) To investigate, record and make public the causes of accidents in civil air navigation in the United States.

"(f) To exchange with foreign governments through existing governmental channels information pertaining to civil navigation."

You state that the Department's method of recording and making public the causes of accidents in civil air navigation is shown in "Comparative Statistics and Analyses of Accidents in Civil Aeronautics for the Years 1927, 1923 and the First Six Months of 1929," a copy of which you enclose. This has, since the date of your letter, been published in Air Commerce Bulletin, vol. 1, No. 14, pp. 9-14, of Jan. 15, 1930. These published statistics do not disclose the cause of any particular accident, but classify, in tabular form, the causes of all accidents, the method of investigation and the manner of tabulating such causes are thus described in the Air Commerce Bulletin (ibid. p. 9):

"The causes of the accidents are divided into four major classifications—personnel, power-plant failures, airplane failures, and miscellaneous. There is a fifth category given over to undetermined and doubtful causes. * * *

"The accident report is based on the findings of the accident board of the Aeronautics Branch, which is composed of two expert pilots, a flight surgeon, an aeronautical engineer, a lawyer versed in air law, and a statistician. This board investigates and determines the causes of all civil-aircraft accidents; analyzes all accidents reported from the field and reduces them to their causation factors expressed in percentage. The statistics gathered from the work of this accident analysis have proved to be of great value, particularly by pointing to ways and means of decreasing the number of aircraft accidents. They also are of great assistance in the development of certain structural and flying characteristics in aircraft."

Harris & Ewing

WILLIAM DEWITT MITCHELL
Attorney General of the United States

The air commerce act of 1926 is entitled "An Act To encourage and regulate the use of aircraft in commerce, and for other purposes," It vests broad powers in the Secretary of Commerce. Among other things, he is given, by section 3, certain regulatory powers with respect to the registration of aircraft, the examination and rating of aircraft, airmen, and air navigation facilities, and the establishment of aircraft rules, and by section 5 authority to designate and establish civil airways and provide for aids to air navigation thereon. The entire act, and especially section 8, indicates an intention to give the Secretary of Commerce wide discretion in its administration, and this purpose was stated in the report of the Committee on Interstate and Foreign Commerce of the House (Report No. 572, 69th Cong., 1st Sess., House of Representatives) of Mar. 17, 1926, as follows:

"The Committee has been mindful of the fact that one of the principal objects to be accomplished by the bill is the encouragement of aviation, and it has therefore left wide discretion in the Secretary of Commerce so that individual operators or other agencies should not be unduly hampered by restrictions or regulations until experience might prove them necessary. It has endeavored to leave the field of invention and experiment entirely free and unhampered by Government interference."

The requirement of subdivision (e) of section 2, here in question, "to investigate, record, and make public the causes of accidents in civil air navigation in the United States," is phrased in general terms, and manifests the purpose above expressed to leave a broad discretion to the Secretary. It contains no specific directions as to the manner or time of publication. Its declared purpose is to "foster air commerce." The duties imposed by the other subdivisions of the section, for the same purpose, are phrased in equally general terms. The entire content of the section discloses the intent to leave matters of detail to the discretion of the Secretary of Commerce, subject to the general requirement that the means adopted must be such as to "foster air commerce."

In an opinion of May 6, 1929, to the Postmaster General (36 Ops. A. G. 33, 36), I used the following language, which is quite applicable here (p. 36):

"The Act itself does not provide any specific method of obtaining bids. The sole direction in that respect being that 'the Postmaster General is hereby authorized to award such contracts to the bidders that he shall find to be the lowest responsible bidders that can satisfactorily perform the service required to the best advantage of the Government.' This language clearly contemplates competitive bidding, and it is equally clear that it leaves to the Postmaster General a very wide measure of discretion as to the means and methods of securing the bids."

A similar matter was considered in an opinion by Attorney General Clifford. (4 Ops. 585.) The act of Mar. 3, 1843, c. 100, 5 Stat. 630, 641, appropriated money for the publication of a Documentary History of the American Revolution, and contained this proviso:

"Provided, also, That the materials which shall compose each successive volume shall, before any appropriation is hereafter made for the cost of the same, be submitted to, and approved by, the Secretary of State for the time being:"

THIS proviso did not prescribe the time at which the Secretary was to give his aproval, and the Secretary submitted for the opinion of the Attorney General the question whether it was sufficient for him to approve the outline of the materials as they were presented by the contractor for each successive volume. The Secretary was advised that such approval might "be fully justified as a reasonable compliance with the requirements of the law."

These opinions are but expressions of the well-settled principle, that, in the absence of specific statutory requirements, incidents of administration lie largely within the discretion of the heads of the several Government Departments. See United States v. Macdaniel, 7 Pet. 1, 14-15; United States v. Wright, 11 Wall. 648; National life Ins. Co. of the United States v. National Life Insurance Co. 209 U. S. 317; Central Trust Co. v. Central Trust Company of the United States, 216 U. S. 251.

The statistical method which you have adopted to "make public the causes of accidents in civil air navigation in the United States" seems to be a reasonable compliance with the requirements of the statute, having in mind its expressed purpose "to foster air commerce." The papers submitted with your letter suggest that the real purpose of demanding detailed information as to the causes of particular accidents may often be to assist private parties in litigation involving the legal responsibility therefor. The publication of such information might make it difficult for the Department to secure frank disclosures from those concerned in particular accidents and might thus hamper the Department in securing accurate information upon which to bass remedial measures for the future. These considerations suggest a possible reason for Congress not requiring any particular method for making public the causes of accidents.

The time of publication is not specified at all in the act, and is thus left largely to your discretion. Of coruse, the intervals must not be so infrequent as to negative substantial compliance with the statutory requirement of publication. I understand, however, that your practice has been to publish statistical material of the sort above described at approximately six-month intervals.

I am of the opinion that the course which you have followed, with respect both to the manner and time of publication, has been within the limits of your discretion under the statute and in substantial compliance with its requirements.

DESIGN OF FOLDING WINGS

CONSTRUCTORS of folding-wing biplanes in the future must make provision on their aircraft for a device which prevents the wing locking pins from being pushed in the holes unless the holes on the two surfaces match, in order to have their Canadian certificates of airworthiness renewed, according to an announcement received from the department of national defense of Canada by the Aeronautics Branch of the United States Department of Commerce, and made public Feb. 20.

The device must be of such a nature that it can be installed in existing aircraft, and so that visual inspection of the locking pin position is not prevented, it was stated. The announcement as received by the Aeronautics Branch follows in full text:

At the present time there is always the possibility that the wings of folding-wing biplanes may be incorrectly spread for flight, in that one of the two locking pins provided on each side for securing the main spars to the center section and body may be pushed in, and may not pass through the holes in both sparts end fitting and the center section fittings.

Constructors of folding-wing biplanes are hereby required to make provision immediately for a device, such that the wing-locking pins cannot be pushed in unless the holes in the spar fittings are matched up with the holes in the center section fittings.

The device decided upon must be of such a nature that it can be installed on existing aircraft, and so that visual inspection of the locking pin position is not prevented.

The Department desires to notify at an early date, the owners and operators of folding-wing biplanes that Canadian certificates of airworthiness will not be renewed unless the device approved for their type of aircraft has been installed. Details of the proposed modification should therefore be forwarded to the department of national defense without delay.

It was stated at the Aeronautics Branch that the Canadian department has requested the branch to distribute this information to American manufacturers of aircraft.

CONTROL OF GERMAN AIR TRAFFIC

Licensing Rules to Govern Public Enterprises

SEVEN ARTICLES contain the rules formulated by the Federal Traffic Ministry (Reichsverkehrsministerium) for the granting of licenses to public air lines wishing to operate through or within German territory.

The Assistant Trade Commissioner at Berlin, A. Douglas Cook, has forwarded a translation of the regulations to the Department of Commerce. The full text follows:

Article I (1). The regulations contained in the air traffic law of Aug. 1, 1922, and such supplementary regulations, proclamations and general administrative orders, are binding for air traffic over Germany. Routes to and from foreign countries are subject to the agreements made between Germany and the respective foreign country.

ARTICLE II (1). The proposed schedule of the carrier is to be submitted to the Minstry of Post and to the Federal Traffic Ministry. The schedule will be published officially in "Nachrichten fur Luftfahrer" (Information for Air Traffic).

(2). A schedule service must be maintained during the entire period mention in the publication of the proposed routes. This service may be stopped or curtailed prematurely only with the approval of the post and traffic ministers.

(3). Changes in the schedule within its period of validity will be approved only where unavoidable exceptions are concerned. Applications and such intended changes must be submitted to the post and traffic ministers at least two weeks before their proposed inauguration.

(4). Only such airports and landing places may be used which have been officially approved for operation.

(5). The airway operator is to attend to the immediate transportation of paying passengers and their baggage from the airport to the city and vice versa in so far as necessary, unless some other fast feeder service is available, such as a local public means of transportation.

(6). The time set for departure in the schedules must be kept in such a manner that the plane is always ready to start at the time mentioned. The time of arrival will be considered as the time when the plane actually lands in the respective airports.

Article III. The general conditions of transportation and tariffs covering the carriage of passengers and freight are to be submitted to the ministries for approval along with the proposed schedules. The passenger tariffs must refer to transportation from airport to airport and to include any possible feeder service.

Article IV. The transportation of mail is to be regulated by agreements direct between the Federal Postal Minister and the airway operator.

Article V (1). Airplane crews are to be kept in constant practice. Every pilot provided for the individual routes should fly on the average at least 20 and not more than 100 hours during the months from April to August. No pilot may be used who is not thoroughly acquainted with the type of plane used on the particular route to be flown. The pilot should obtain an adequate knowledge of the route either by special flights or as a second pilot.

THE second set of controls may be handled only by holders of a pilot's license for the corresponding class of airplanes, also licenses restricted to noncommercial passengers transportation, or, by special permission, by mechanics. Such individuals must be declared in a sound physical condition by an officially recognized physician, and must be able to prove proper training, and must have a sufficient knowledge of airplane piloting, so that they may land the plane independent of the pilot.

In single-motored planes mechanics in the course of training may also be used on the second controls. Planes of Class C on long-distance flights with passengers must be manned with a second pilot.

A mechanic may act as second pilot on a multi-motored plane only after he has flown at least 20,000 kilometers on single-motored planes as mechanic. The mechanic must carry his license at all times and show it to the proper authorities upon demand. The transportation of passengers in the pilot's cabin is prohibited if a second set of controls is installed.

(2). Only modern cabin planes with at least four seats for passengers may be used in passenger traffic. Former army or navy planes may not be used, even if changes have been made. The planes and motors must correspond to the regulations for construction issued by the Deutsche Versuchanstalt fur Luftfahrt (D. V. L.), (an aeronautical experimental institute). Planes and motors as well as board instruments must have been examined and approved by the D. V. L.

The planes must be fitted with such equipment as to insure the greatest safety and comfort for the passengers. They must further carry a fire extinguisher and a first-aid cabinet. The first-aid cabinet must be placed in such a position in the plane where it is least endangered in case of accident and is easily accessible from the inside and the outside of the plane. All multimotored planes must be equipped with radio apparatus, which must also be in use.

(3). Sufficient trained personnel and the necessary spare parts must be held in readiness on every airport or landing place touched according to the schedule. The planes must be kept in constant good condition during the whole of the flying year, and if necessary their numbers must be immediately augmented.

(4). Before each flying period the airway operator must furnish the ministries in question the following information:

(a) Location of the head office, names and addresses of the directors, names and stations of the local members.

(b) Names of pilots, with information covering their detailed flying experience. Special mention must be made of those pilots who were trained later than the year 1918.

(c) The types of planes used.

(d) Repair shops and stocks of spare parts.

(e) Names of persons employed in the flying radio service separated according to whether radio operation is their exclusive field or in connection with other activities.

Traffic over any route may not be commenced before the traffic minister has approved the proposed personnel and material.

(5). The planes specified in (4) may be used on week days for other purposes than the intended scheduled route service only if the regular service is in no way influenced. Such special flights are to be distributed over the different routes in such a manner that schedule of planes is maintained.

(6). The pilots, as far as possible, will obtain their meteorological information personally in the weather office, where the prescribed weather chart will also be furnished them. This weather chart must be immediately available throughout the flight.

(7). Accidents resulting in personal injury or death must be reported immediately by telegraph or telephone to the nearest airport radio station or direct to the Federal Ministry at Berlin.

(8). The regulations covering the air radio service issued by the Central Office for Safety in Aeronautics (Zentralstelle fur Flugsicherung) must be observed. The radio equipment on board airplanes may be handled only by operators in possession of the prescribed second class license for radio service issued by the Federal Postal Ministry.

Article VI (1). The airway operator must allow officials appointed by the Federal Traffic Ministry an insight into the technical operations and the administration of the carrier. These officials are entitled to request information covering every phase of the company's activities, and have the right to inspect the company's operations at any time.

(2). The officials of the Aeronautics Division of the Traffic Ministry and the officials mentioned in (1) must be treated as paying passengers, but must be carried free of charge. Free transportation over routes operated in cooperation with foreign companies shall be given only in exceptional cases, and such travel is to be made only in German airplanes and only with the approval of the other cooperating companies.

NOTIFICATION of free flights on routes jointly operated with foreign companies will be given 10 days in advance; for other trips a notification period of 72 hours will be respected. The company is not obliged to make available for this purpose seats which have already been sold.

(3). The airway operator is obliged to submit currently all necessary information for the compilation of aeronautical statistics.

(4). The company is obliged to furnish the Central Office for Safety in Aeronautics with special lists covering the radio apparatus carried on board the planes. Information showing changes in the installation and operation of the equipment mentioned in the lists must be submitted to the Central Office for Safety in Aeronautics prior to the fifteenth of every month. A list in accordance with Article V (4) must also be submitted the Central Office.

Article VII (1). In case of the violation of any of the aforementioned regulations or if any special obligations are not respected by the company the license for airway operation will be withdrawn and legal proceedings may be taken.

(2). The Traffic Minister reserves the right to supplement or change the conditions of licensing. In the event of such a change two weeks' notification in advance will be given.

UNIFORM RULES FOR STATES

JOHN M. VORYS, director of aeronautics, State of Ohio, attended a legislative air parley of the midwest States, held at Milwaukee, Wis., Feb. 25 and 26. He says:

This conference represented eight of the middle western States which have somewhat similar problems in aeronautics with reference to the legislative regulation and promotion of aeronautics. In this group Ohio and Michigan are the only States having directors of aeronautics.

In addition to legislative and other representatives from the various States, four of the leading authorities on aviation law were present: Prof. Carl Zollmann, of Marquette University; Prof. Fred D. Fagg Jr., of Northwestern University; Rowland W. Fixel, of Detroit, and George B. Logan, of St. Louis. Representatives of the Department of Commerce, National Aeronautical Association, Aeronautical Chamber of Commerce of America, and of aviation transport lines, were also there. Mrs. Mabel Walker Willebrandt was present, representing aviation court.

The conference passed resolutions urging Federal and State aid to airways similar to the Federal road laws; survey and planning of State airway systems, to be financed by the State; compulsory rating and marking of airports, and State standards for minimum size of airports to be used for commercial flying; State control of flying schools.

The conference went on record as approving the Ohio plan of adopting the Federal license for aircraft and pilots, but provided that this license should extend to private as well as commercial planes and pilots, and the conference recommended that every State follow Ohio's lead in providing compulsory air-marking of municipalities.

CONSTRUCTION WORK ON AIRPLANE WING

Ewing Galloway, New York.

Workman Building up Front Spar of Airplane. Skeletonized Spars, Spliced and Freshly Glued, are Held in Grip of Vice

Army Air Reserves

INSTRUCTIONS have been issued by the Secretary of War that not more than 25 per cent of the total number of Air Corps officers on duty in the Hawaiian and Panama Canal Departments be procured from Air Corps Reserve officers ordered to extended tours of active duty with the Air Corps, the War Department announced Jan. 21. An increase in the officers of the Air Corps alloted to the Hawaiian Department from 61 to 75 has also been authorized, it was stated. The announcement follows in full text:

The Secretary of War has directed that not to exceed 25 per cent of the total number of Air Corps officers on duty in the Hawaiian and Panama Canal Departments be procured from Air Corps Reserve officers ordered to extended tours of active duty with the Air Corps.

These instructions were issued upon the recommendation of the Chief of Air Corps, Maj. Gen. James E. Fechet, who stated that the tactical units in foreign possessions are in a position to give excellent training to Reserve officers and that full advantage should be taken of this fact.

The Secretary also authorized an increase in the officers of the Air Corps allotted to the Hawaiian Department from 61 to 75. The strength of Air Corps officers in the Panama Canal Department will remain as at present, 41. The Reserve officers who will be ordered to these departments will be those who graduate from the Air Corps Training Center, San Antonio, Tex., Feb. 15, 1930.

HOW THE ARMY AIDS AVIATION

Army Air Corps

First Pursuit Group Planes Equipped With Skiis for Winter Maneuvers

Benefits to Commercial Aviation From Military Tests and Experience

COMMERCIAL aviation, which has made its greatest strides in recent years, has drawn huge benefits from the fund of practical knowledge obtained through military aviation, the Assistant Secretary of War, F. Trubee Davison, stated Mar. 4.

As a matter of fact, the War Department, through its Army Air Corps Material Division at Dayton, Ohio, has made numerous basic contributions toward the improvement of aircraft and motors. According to Mr. Davison, there is no substitute for experience, and since the Army has flown more than any other single agency, its experience is wide and intensive.

Although the Federal Government has clearly defined the duties of the Departments of Commerce, War, and Navy with respect to the development of commercial, Army and naval aviation, there are a number of important points on which commercial and military aviation, for their mutual advantage, must proceed hand in hand, he said.

For instance, Mr. Davison pointed out, the development of airports comes wholly within the jurisdiction of the Department of Commerce, but at the same time, the War Department, needing airports for its Army planes as much as steamship lines need harbors for their boats, is intensely interested in the construction of municipal landing fields. They are the important links in the future airways of the Nation.

ON THE other hand, experiments in motor and airplane construction, conducted at Army and Navy test laboratories have produced results of enormous benefit to commercial aviation, as have the contributions made by these Government departments toward the solution of aerial navigation problems.

Military aviation, it was said, for its eventual effectiveness in a large emergency, depends upon the support it can get from a well-established aircraft industry and from an air-trained civilian personnel. Without such support, military aviation is seriously handicapped. The Government has taken steps, through the five-year Army Air Corps development program, to give this country an Army Air Corps of 1,800 service planes, 1,650 flying officers, 550 Reserve officers on active duty and 15,000 enlisted men, by the end of 1932.

In the opinion of Mr. Davison, from the military point of view, commercial aviation is as necessary as steamships, railroads and other means of transportation. The more done to expedite the growth of commercial aviation, the more done to strengthen the aerial reserve of this country in case of war.

A WELL-ESTABLISHED commercial air activity would produce a strong industry, he explained. It would stimulate engineering genius always seeking new realms to conquer. It would create a great reserve for trained mechanics and pilots and—not least important—widespread commercial air activity would result in the establishment and maintenance of an expansive system of airports. Military planes depend upon airports for their mobility as much as other branches of the Army depend upon highways and railroads. Airports, in brief, are vitally important to the Nation's defense.

Mr. Davison added that the relationship between commercial and military aviation is not a one-sided affair. In its early stages, the airplane was put almost exclusively to military use.

The experience of the War Department has naturally been of great value in determining the efficiency and serviceability of different types of plane and motor construction, as well as in demonstrating the most advantageous methods of maintenance and operation, he said. Mr. Davison pointed out that it was the Army that flew our early planes. It was the Army that furnished our first air-mail pilots. It was the Army that laid the foundation for our present transcontinental system of airways. It was the Army which—through its technical experts—increased the safety and practicability of flying by perfecting the parachute, the radio beacon, the earth inductor compass and many other devices which have come to be almost necessities to aerial navigation.

The greatest enemy of flying today is fog, and hence we can point to progress, which indicates that in the not distant future that enemy will be completely defeated, the Assistant Secretary explained. We have now learned to fly hour after hour in fog without any horizon, without being able to see the sky, or the ground, by means of instruments which were developed principally by Army engineers, he continued.

Army Air Corps

The Assistant Secretary of War, F. Trubee Davison, in Flying Costume

WHILE flying in fog has virtually been made safe, the next question is how does the pilot get his plane to his destination when all landmarks are hidden? Here again, Mr. Davison said, the Army has made a vital contribution to flying because of the very important role it has played in the development of the radio beacon. All a pilot who flies on the beacon has to do is to follow a yellow light on the instrument board in his plane. When the light changes from yellow to green or red, he knows he is either to the right or to the left of his course and gets back through the simple expedient of kicking his rudder until the light shows yellow once more, it was explained.

In other words, the radio beacon is an electric highway that stretches over distances of hundreds and hundreds of miles. No gale can scatter it, no fog can obliterate it. It makes no difference how strong the storm is or how poor the visibility, the radio beacon will carry the pilot to his destination. That is, it will bring him above the field, but it will not enable him to land. To overcome handicaps imposed upon pilots who are compelled to land on airports hidden by heavy fog, experiments are being conducted with an instrument commonly known as a capacity altimeter. The altimeters now in use work under atmospheric pressure and indicate within one or two hundred feet the height of the plane above sea level. While that is fairly important information, it is not enough for a pilot who has to land in fog. For that reason the capacity altimeter, which measures the exact distance the pilot is above the ground immediately below him, is of enormous value, it was said.

THROUGH the great advances that have been made recently to refuel planes in the air, and through the added certainty and safety offered by radio, the Army Air Service has put on "seven league boots" and extended its effective range of operations.

The Assistant Secretary stated that the industry and operating companies are drawing heavily on the Army for pilots and technicians. "We dislike to see them go, but there is consolation in the knowledge that their experience is to be devoted to commercial aviation progress in America."

SOUNDPROOF AIRPLANE CABINS

Ewing Galloway, New York

Interior of Cabin of a Ford Plane in Detroit-Cleveland Service. More Comfortable Than a Railroad Train and Twice as Speedy.

Insulation Construction Designed by Bureau of Standards as Result of Scientific Experiments

By V. L. CHRISLER, Scientist, and W. F. SYNDER, Assistant Scientist, Federal Bureau of Standards

THIS PAPER is the first report of an investigation which is being carried out by the Bureau of Standards for the Aeronautics Branch of the Department of Commerce for the purpose of developing, if possible, practicable methods for reducing noise in the cabins of airplanes. It is, of course, desirable to reduce the noise as much as possible at its source, and more efficient exhaust mufflers may be developed which will contribute to this end. It may also be possible to reduce somewhat the noise of the propeller. At present, however, the soundproofing of the cabin seems to afford the most promising line of attack.

This problem is not a simple one. The noise of an airplane in flight has been found [1] to be of a very complex character, containing sounds of both high and low frequency. Othef work on sound transmission shows that many materials are much better sound insulators at high frequencies than at low ones. The noise of an airplane engine is to a large extent composed of sounds of low frequency, in the region of 200 cycles per second. Tucker calls attention to the fact that in multimotored planes low-pitched beat notes may be produced when two engines are running at slightly different speeds.

IN ADDITION to the difficulty of insulating against noises of such a character the question of weight must be considered. In this respect the limitations are severe. It is also to be recognized that the engine and cabin are both attached to the same frame. This allows vibrations from the engine to be transmitted by solid conduction directly into the cabin.

Taking all these facts into consideration, it seems that the most practicable way to obtain a reasonable degree of quiet without excessive weight is to build the cabin walls in layers. Such a structure when composed of light materials may give rise to a considerable amount of back reflection at each surface of discontinuity, thus producing on the whole a greater opacity to sound than would be a homogeneous wall of the same weight.

For the determination of the best materials to be used in such a construction a large number of transmission tests were made on common materials heavy and light—the lightest being a sheet of wrapping paper. In these experiments the transmission was measured at three different frequency bands, 150-220, 400-470, and 1,000-1,120 cycles per second. It was felt that the lowest band would represent fairly well the fundamental frequencies that characterize the noise from the engine exhaust, while the highest band would correspond approximately to overtones or other high-pitched noises that may occur with any considerable intensity.

Method of Measurement.—The method used in measuring the sound transmission of the various materials and their combinations was that described in a previous publication [2]. In all these measurements the test panels were placed in the horizontal opening between the upper and lower rooms in the sound chamber building. It was found advisable to reduce this opening to fit the size of the sheets of material tested as cross supports were thus avoided. This reduction was effected by the use of 8-inch concrete blocks. The size of the opening used was 21½ by 40 inches. The samples were placed on top of this opening and sealed around the edges to prevent sound leakage.

All the materials tested had relatively high values of sound transmission, in comparison with which any transmission through the concrete blocks was negligible.

METHOD of Expressing Results (Sensation Units)—All results given in this paper and in the previous publication above referred to [2] have been obtained by use of the telephone receiver as a detector and measurer of sound energy. The indications of this instrument are given on what is called the physical scale, which measures the energy of the sound wave. But the instrument most universally used for detecting sound and estimating its intensity is the human ear, and unfortunately the ear does not respond according to the physical scale. As the intensity of a sound increases steadily on the physical scale the response of the ear fails to keep pace with it. There appears to be in the ear a regulating or protective mechanism whose nature is not clearly understood, which, like the well-known mechanism of the eye, protects that organ against excessive stimulation. Experience shows that the response of the ear is proportional to the logarithm of the physical intensity; that is, energies proportional to 10, 100, and 1,000 would produce in the ear effects proportional to 1, 2, and 3, respectively. This logarithmic scale has been termed the ear scale.

A slight modification of this scale has been employed for some time by telephone engineers [4] and is used on all audiometers made by the Western Electric Co. This scale merely multiplies the numbers of the ear scale by 10, the unit of this new scale being that fractional change in intensity which is approximately the smallest that the average ear can detect. For this reason it is called a sensation unit. In the example given above, intensities corresponding to 1, 2, and 3 on the ear scale would be represented by 10, 20, and 30 sensation units.

Wallace Waterfall [5] has suggested a way of illustrating the values of sensation units in familiar terms. We may call it an ear sensation scale. (Fig. 1.)

DISCUSSION of Results—When the work was first started, it was thought that possibly some materials, such as fiber boards, might have a greater degree of sound insulation than a sheet of metal of the same weight. When the results were plotted—the reduction factors in sensation units against the logarithm of the weight per square foot—a straight line was obtained (fig. 2), the points in every case following close enough to the line to be within experimental error. This indicated that weight was the predominating factor rather than the nature of the material.

The next attempt was to use two sheets of material with an air space between them. Two sheets of aluminum with a 1¾-inch air space between them gave an average reduction factor of 14.6 sensation units, while a single sheet of the same aluminum gave 17.9. When this result was first obtained it was thought to be due to some error in measurement, but a repetition gave the same result. Sheets of fiber board and of glass were tested in the same way. With these materials the presence of an air space showed a slight decrease in transmission compared with that of a single sheet, but, at least at low frequencies, the advantage gained was not enough to compensate for the increased weight.

It appears that two thin sheets of metal may be so flexible that the air between them may act as a mechanical tie, causing the two sheets to vibrate together and thus transmit sound. With more rigid materials, such as glass, this effect is less noticeable and a slight improvement in opacity may result. The point for this combination (panel 20) falls just a little above the straight line which was drawn for homogeneous materials (fig. 3). Had the air space been very effective the point would have been found much higher. For two sheets of one-half inch insulite (panel 22) there is quite an improvement, the point coming considerably above the line.

Insulite is not as stiff as glass, and, therefore, by the previous reasoning should not have given a lower transmission. Insulite, however, possesses a quality not found in glass or metal, which may account for this difference. This is its greater absorptive power for sound, which may be from 15 to 20 per cent as compared with from 1 to 3 per cent for glass and metal. In the case of fiber-board sheets separated by an air space the absorption occurring at each back reflection prevents the sound from building up in the air space to an intensity sufficient to penetrate the second sheet to the same extent as with less absorbent materials.

If this is correct, the introduction of absorbing material between two sheets of thin metal, such as aluminum, should decrease the transmission of the combination. Panel 36 was thus constructed and, as may be seen in fig. 3, its reduction factor came out about eight sensation units greater than might have been expected on the basis of weight alone. In building construction it has been found [6] that no appreciable improvement is obtained by introducing sound-absorbing materials between two masonry walls or between two solid plaster partitions separated by a small distance. It is remarkable that this same rule does not seem to apply to very light structures.

There is considerable freedom of choice in the filling material. Balsam wool, cotton, and hair felt were tried with similar results. Such an arrangement gives a reduction factor which is as great as might be expected from a homogeneous material of twice the weight.

PANEL 38 was built with two layers of balsam wool separated by a very thin sheet of aluminum with the idea of obtaining still better results. Measurement, however, showed no improvement over panel 28, which did not contain the central sheet of aluminum. The same plan was tried in panel 39, which contained alternate layers of cotton and wrapping paper, but without satisfactory results.

A combination of sheet aluminum, absorbent material, and fiber board (panel 33) was found to give a reduction factor equivalent to that of a homogeneous partition of about three times its weight.

Fig. 3 shows graphically the results obtained by various combinations of materials. The straight line, representing the values that might have been expected if the weight

[1] The Problem of Noise in Civil Aircraft and the Possibilities of Its Elimination, W. S. Tucker, A. M. I. E. E., January, 1928.

[2] B. S. Sci. Paper No. 526, Transmission and Absorption of Sound by Some Building Materials.

[3] See footnote 2.

[4] Fletcher, Bell Telephone Laboratories, Reprint B-152-1, J. Frank Inst.; September, 1923.

[5] Engineering News Record; Jan. 10, 1929.

[6] B. S. Sci. Paper No. 552; Paul Sabine, The Armour Engineer; May, 1926.

AIR PASSENGERS to TRAVEL in NOISELESS CABINS

were the only factor to be considered, furnishes a basis of comparison. This figure gives, in general, a somewhat distorted representation, being plotted to the logarithm of the weight in order to obtain the straight line. In fig. 4 the same data have been replotted, using the weight per square foot as the abscissa. From fig. 3 it might be inferred that panel 36 is the best combination, but fig. 4 shows that this panel is nearly twice as heavy as panel 33, while its reduction factor is only five sensation units greater. Considering weight, panel 33 gives the best results of all combinations tested.

To test this further, a larger panel, No. 40, of the same structure as panel 33, was built on a light wooden frame. On test its reduction factor was found to be 36, as compared with 30 for the smaller panel.

TESTS in Airplanes in Flight—The preliminary tests above described having indicated the possibility of constructing a panel sufficiently light to be used in an airplane and yet of considerable opacity to sound, arrangements for tests in actual flight were made by the courtesy of the Army Air Corps and of the Bureau of Aeronautics of the Navy.

In these flights a Western Electric audiometer, type 2-A, was used as a measuring instrument for intensity of sound. This instrument has certain limitations. The most intense airplane noises are of low pitch and rather too loud to be matched by the audiometer. In addition, the audiometer gives only notes of one frequency at a time, not a complex noise. But by making use of the masking effect of noises it was possible to get a fair idea of the reduction factor of the different cabins tested. The agreement of several different observers on this point was good.

Tests were made in the cabin of a Fokker trimotored plane placed at our disposal by the Army Air Corps. The cabin of this plane was a framework covered on the outside with airplane fabric and on the inside with plywood. The reduction factor was about 10 sensation units.

A Ford trimotored plane, furnished by the Navy, had a cabin covered on the outside with corrugated duralumin. A thin layer of kapok in burlap covers was attached to the inside of this metal sheet. Over this kapok was a layer of some composition resembling leather in appearance. The windows were of plate glass approximately one-eighth inch thick. The reduction factor for this cabin was about 20 sensation units.

From audiometer measurments the average close-up intensity of the noise of an airplane in flight is about 95 sensation units. If a cabin could be built with a reduction factor of 35 units, the intensity of the noise within the cabin (60 units) would be about that in a railway coach in motion. Panel 40, of reduction factor 36, gave promise of furnishing this result.

Before modifying an airplane cabin in this way three model cabins were built for laboratory test, each about the actual size of the cabin of a 4-passenger Fairchild plane.

Cabin No. 1 was covered with a thickness of airplane fabric, doped and varnished as in ordinary practice. Cabin No. 2 was covered both outside and inside with 3-ply plywood, leaving an air space of 1¾ inches between the two layers. Cabin No. 3 (fig. 5) was covered on the outside with 0.02-inch duralumin, and on the inside with one-fourth inch insulite. The space between was filled with a fibrous material known as dry zero blanket. This is a natural fiber which is stated to have the unusual property of having the end of each tubular fiber closed.

An additional layer of 2-inch dry zero blanket was placed over the insulite, and the inside was finished by a protective coating of perforated sheet aluminum. The object of this is not materially to decrease the transmission, but to absorb such sound as may be transmitted into the cabin. It can be shown theoretically[1] that if there is no absorption in a closed space the intensity in this space after a steady state is reached the inclosure, no matter how good a is the same as the intensity outside sound insulator the walls may be.

For this reason it is advisable to line the interior of the cabin with some very absorbent material to prevent the sound that does pass through from building up to a disagreeable intensity. Any material which has a relatively high absorption at the lower frequencies will serve this purpose. Unfortunately, few materials are good absorbers at low frequencies. Taking weight into consideration, dry zero blanket was the best absorber that was found. It has, therefore, been used in all of these tests.

[1] See footnote 2.

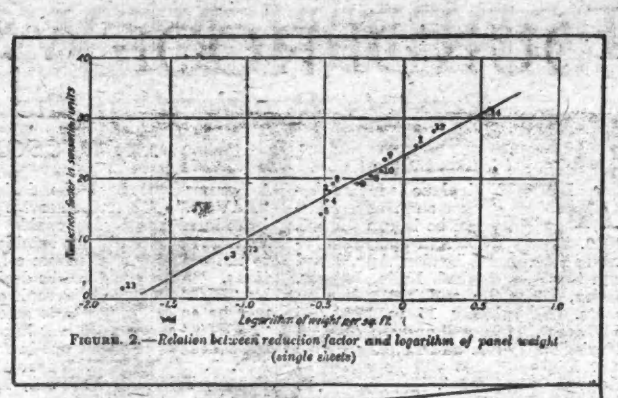


FIGURE 2.—*Relation between reduction factor and logarithm of panel weight (single sheets)*

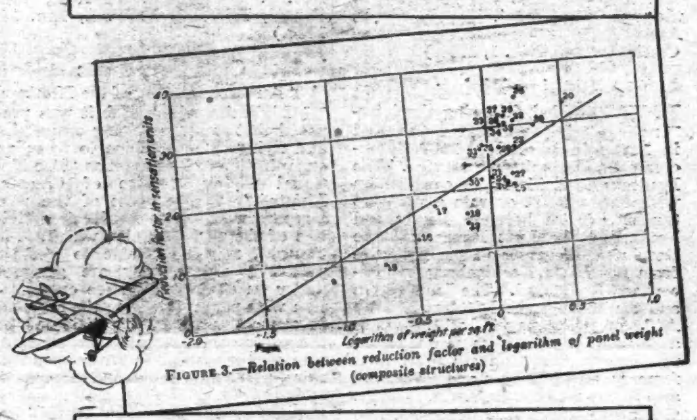


FIGURE 3.—*Relation between reduction factor and logarithm of panel weight (composite structures)*

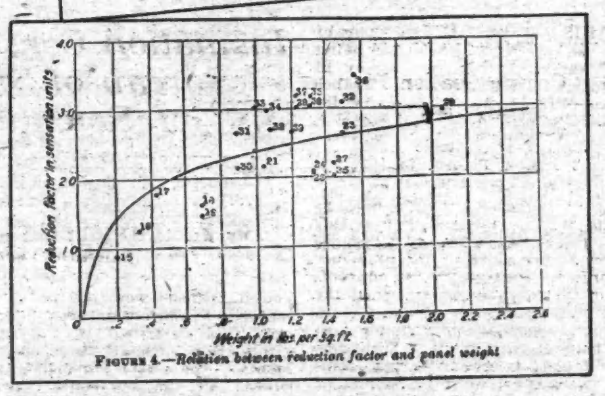


FIGURE 4.—*Relation between reduction factor and panel weight*

THE WEIGHT, in pounds per square foot of each construction (exclusive of the wooden frame), was approximately as follows:

Cabin No. 1	0.1 Pounds
Cabin No. 2	1.04 "
Cabin No. 3	1.24 "

The cabins were then placed in the reverberation room where a comparatively loud sound of varying frequency could be produced. Audiometer tests were made at four different frequency bands. The results, expressed in sensation units, are given in Table 1.

TABLE 1.—*Reduction Factor in Sensation Units for Frequencies*
(Cycles per second)

Cabin	150-187	250-285	500-547	1,000-1,070	Mean
1	F	5	5	5	4
2	15	15	18	23	18
3	30	28	28	35	30

The results obtained with cabin No. 3 were regarded as sufficiently encouraging to warrant the modifying of an actual airplane cabin for experimental test. Permission was obtained from the Navy Department to make a temporary installation in the cabin of the Ford plane, in which one of the previous flights tests was made.

For purposes of comparison it was decided to divide the cabin into two parts, modifying one half and leaving the other in its original state.

The interior finish of the forward part of the cabin was removed, and a 2-inch layer of dry zero blanket placed next to the outer metal covering. Over this was fastened a layer of fiber board one-fourth inch thick. Over the fiber board was placed another 2-inch layer of dry zero blanket, and the inside was finished with perforated sheet aluminum. The windows, being of rather thin glass, would have interfered with the tests, and were also covered. To give results equivalent to the rest of the structure the glass should have been one-fourth inch thick.

The measurements in flight were made by three observers. The average reduction factor of the treated portion of the cabin was 18 sensation units greater than in the unaltered part. As mentioned above, the unaltered cabin had a reduction factor of 20 units as compared with outside measurements. It thus appears that the treatment applied to the cabin gave a reduction factor of 38.

Observations were made as to the ease with which conversation could be carried on while the plane was in flight. In the unaltered part of the cabin it was necessary to raise the voice and frequently to repeat a sentence. In the treated portion one could talk in an ordinary tone and be understood by another as far away as the size of the cabin allowed, and it was seldom necessary to repeat.

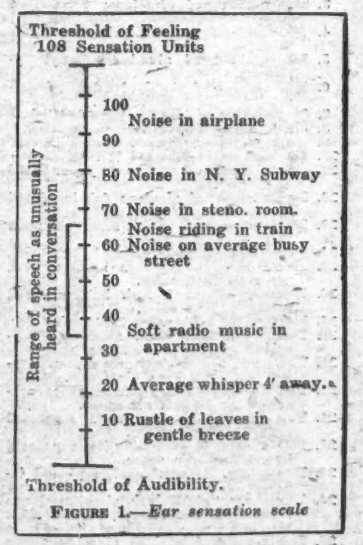


FIGURE 1.—*Ear sensation scale*

It was the judgment of the observers that most of the residual noise in the cabin came through the floor, which had received no treatment. It is probable that the floor also could be protected against sound

[Continued on Page 8, Column 1]

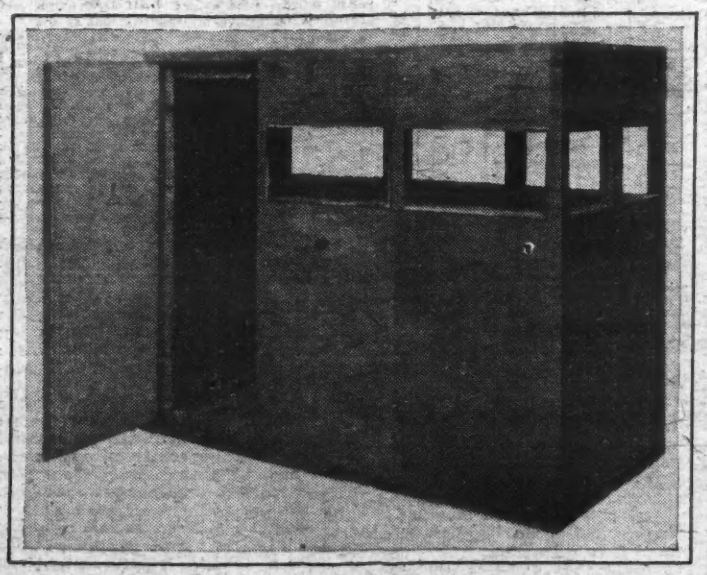


Figure 5.—Experimental Test Cabin, No. 3

FOREIGN NEWS ABOUT AVIATION

Reports Received in the Department of Commerce From Representatives Abroad

A DIRECT airplane service between Prague and Basel, Switzerland, will be begun June 1, 1930. Planes will begin operation between Prague and London, Apr. 2, and will touch Marienbad, Halle, Leipzig, Essen, Muhlheim and Rotterdam en route. From May 15 to Sept. 15 additional planes will operate between Marienbad, Halle and Leipzig. Five new Fokker planes will be added to the present equipment. (Sam E. Woods, Assistant Trade Commissioner, Prague, Czechoslovakia, Feb. 1, 1930.)

Sunday Flying

IT WAS decided, following the international air traffic conference, held in Berlin in December, 1929, to increase Sunday schedule service. The Deutsche Luft Hansa in conjunction with Farman will operate a non-stop Sunday service between Berlin and Paris, and the Luft Hansa and the Deruluft will operate a Sunday service from Berlin via Koenigsberg to Moscow and Leningrad. The Luft Hansa and the Det Kanske Luftfart Selskab A/S, of Copenhagen, will operate a joint Sunday service from Berlin to Copenhagen. The air mail lines from Berlin to London and Paris will also be flown on Sundays. (A. Douglas Cook, Assistant Trade Commissioner, Berlin, Germany, Jan. 24, 1930.)

Communication Plan

THE Imperial and International Communications, Limited, has authorized the Pacific Cable Board West Indian System to institute a telegraph-air mail service at much reduced rates, approximately one-fourth the ordinary rate, with a minimum charge of 24 words. This will enable the islands which have no air mail service to take advantage of the new service for communications. Thus Grenada, St. Vincent, Barbados, Dominica, Montserrat and St. Kitts will be able to forward telegrams at the low rate to the airplane points of call for transmission beyond by air mail. The points of call in the British West Indies region are Antigua, St. Lucia, Trinidad and Georgetown. The telegrams will bear the designation "PAVLT." A further service will be introduced shortly to enable islands having frequent mails to outside points to use outgoing mails from other stations. This service will be designated by "PLT" and the telegraph charges will be on the same basis as for the "PAVLT" service. It was hoped that the schedules could be put in force on Feb. 1. (Alfred L. Demorest, Vice Consul, Trinidad, B. W. I., Jan. 25, 1930.)

Canadian Clubs

AT A recent meeting of the Montreal Light Aeroplane Club it was proposed that small operating companies and flying clubs combine to form an organization to be known as "The National Flying Service of Canada, Limited." The purpose of the new company would be to coordinate activities of the various units, which, it is thought, may be unable to operate profitably unless they are grouped under an efficient directive organization with power to act on their behalf in connection with the petitioning of the government for subsidies, elimination of duplication in air transportation—mail, passenger and express—and also to encourage better conditions in Canadian aviation schools. No definite steps have been taken towards the formation of such an organization. (L. A. France, Assistant Trade Commissioner, Montreal, Canada, Feb. 11, 1930.)

In Switzerland

AIR TRAFFIC at Basel, Switzerland, during 1929 showed an increase in every branch except in the amount of luggage carried. This decrease is probably due to the fact that many of those who use the air lines have learned from experience to travel with less baggage. The number of passengers increased from 6,191 in 1928 to 6,825 in 1929. There were eight lines operated from Basel to the following cities during the year 1929: Basel-Zurich-Paris-London, Basel-Zurich-Brussels-Amsterdam; Basel-Zurich-Munich-Vienna-Budapest, Basel-Geneva-Marseille-Barcelona, Basel-Frankfort-Berlin, Basel-Chaux-de-Fonds-Lausanne-Geneva, Basel-Bienne-Berne and Basel-Genoa-Alexander-Bagdad-Karachi (India).

A new weekly service was inaugurated Mar. 30, 1929, from London to Karachi, via India, Basel, Genoa, Rome, Syracuse, Alexandria, Bagdad and Bushire. Other new developments for the Winter season of 1929-1930 will be triweekly flights on the lines from Basel to Geneva, Marseille and Barcelona, and from Basel to Paris and London.

The only local company operating air lines to and from Basel, "Balair," has recently increased its capital from Swiss francs 330,000 ($63,706) to 500,000 francs ($96,525) and in the month of November, 1929, an order was placed for 18 motors of American manufacture, valued at $4,420 each. During the year 137,533 kilometers were covered within 97 per cent of schedule time, and with only one emergency landing, due to motor defect. There were no accidents of any kind reported throughout the year. (Calvin M. Hitch, Consul, Basel, Switzerland, Jan. 13, 1920.)

New Zeppelin

A HUGE Zeppelin is to be built during 1930 by the Zeppelin Airship Company. The new ship, the "LZ-128," a sister ship of the Graf Zeppelin, will be over 740 feet long. It will be larger than the English R-100 and R-101, but many features in the design of the British craft, such as the arrangement and situation of the passenger quarters, will be adopted. It is expected that the ship will be completed by the Summer of 1931. (H. C. Scheutte, Assistant Automotive Trade Commissioner to Europe, Paris, France, Jan. 29, 1930.)

Traffic in Spain

THE Compania de Lineas Aereas Subvencionadas, S. A. (Company of Subventioned Air Lines) which maintains air service from Madrid to Seville and Barcelona, announced that from the inauguration of the company's activities in May, 1929, until the end of the year, 743 flights were made, 2,316 hours were flown, and 3,888 passengers and 20,906 kilograms of merchandise were carried. There was no accident during the entire period. (Charles A. Livengood, Commercial Attache, Madrid, Spain, Jan. 28, 1930.)

In South America

AN OFFICIAL of the Compagnio General Aeropostal conferred during December, 1929, with officials of the Bolivian Government regarding projects to link Bolivia with services of the company in other South American countries. At the end of the year it was felt that the government would probably act favorably on the French company's proposals. (George G. Trueblood and Sheldon T. Mills, Vice Consuls, La Paz, Bolivia, Jan. 17, 1930.)

Lighting Trial

TESTS at the Kastrup airport have been made recently of beacon lights with a view to finding a signal light to be used on the proposed night air route Copenhagen-Roby. It is understood that the lights to be used will have a strength of 1,000,000 candlepower. One of the lights tested, the product of a German factory, sends out two beams, one closely following the other. Top lights, which can be operated quite independently of the beacon lights, can be inserted in the lighthouse itself for the purpose of giving directions. (Paul H. Pearson, Assistant Trade Commissioner, Copenhagen, Denmark. (Jan. 22, 1930.)

Channel Crossing

FIVE MILLION miles of cross-channel schedule flying were recently completed by the air fleet of Imperial Airways, English air line operating between London and Paris. This represented approximately 20,000 flights in which more than 100,000 passengers were carried between London and the Continent. (H. C. Schuette, Assistant Automotive Trade Commissioner to Europe, Paris, France, Jan. 29, 1930.)

SOUNDPROOF AIRPLANE CABINS

[*Continued from Page 7.*]

If this were done at the time the plane was built.

Description of Panels.—Unless otherwise specified the materials were fastened to a wood frame made of 1¾ by 1¾-inch stock. The outside dimensions of the panels were 25 by 43½ inches.

Panel No.

1. Single sheet of galvanized iron 0.01 inch thick.
2. Single sheet of aluminum 0.025 inch thick.
3. Single sheet of aluminum 0.006 inch thick.
4. Single sheet of duralumin 0.020 inch thick.
5. Single sheet of aluminum-coated duralumin.
6. Single sheet of standard celotex building board 7/16 inch thick.
7. Single sheet of insulite ½ inch thick.
8. Single sheet of insulite ¼ inch thick.
9. Single sheet of plywood ⅛ inch thick.
10. Single sheet of plywood ¼ inch thick.
11. Single sheet of wrapping paper 0.006 inch thick.
12. Single sheet of airplane fabric, doped five times, varnished two times.
13. Single sheet of double-strength glass ⅛ inch thick.
14. Single sheet of plate glass ¼ inch thick.
15. Single sheet of ½ inch balsam wool, paper on both sides.
16. Single sheet of 1 inch balsam wool, paper on both sides.
17. Single sheet of insulite 5/16 inch thick.
18. Two sheets 0.025-inch aluminum separated by ½-inch air space.
19. Two sheets 0.025-inch aluminum separated by 1¾-inch air space.
20. Two sheets double-strength glass separated by ½-inch air space.
21. Two sheets ⅛-inch plywood separated by 1¾-inch air space.
22. Two sheets ½-inch insulite separated by 1¾-inch air space.
23. Two sheets ½-inch insulite placed together.
24. Single sheet 0.025-inch aluminum, one sheet 7/16-inch celotex, second sheet aluminum.
25. Single sheet 0.025-inch aluminum, one sheet ½-inch insulite, second sheet aluminum.
26. Single sheet 0.025-inch aluminum, ⅝-inch air space, one sheet 7/16-inch celotex, ⅝-inch air space, second sheet aluminum.
27. Single sheet 0.025-inch aluminum, ⅝-inch air space, one sheet ½-inch insulite, ⅝-inch air space, second sheet aluminum.

Table Showing Reduction Factor in Sensation Units at Various Frequency Bands

Panel No.	Reduction factor in sensation units at frequency bands of—				Weight per square foot	Log of weight per square foot
	150-220	400-470	1,000-1,120	Average		
					Pounds	
1	24.5	28.7	28.6	25.5	1.2	0.08
2	16.1	17.3	20.3	17.9	.35	−.46
3	5.5	6.6	8.3	6.8	.075	−1.12
4	16.6	16.4	14.1	12.4	.32	−.49
5	9.6	15.9	16.9	14.1	.30	−.52
6	17.1	20.3	26.0	20.5	.62	−.20
7	21.4	23.3	25.0	23.2	.75	−.12
8	20.9	16.3	20.3	19.2	.36	−.44
9	17.5	18.7	21.6	19.3	.52	−.28
10	18.6	20.6	24.5	21.3	.73	−.14
11	1.6	1.8	2.3	1.9	.017	−1.80
12	5.3	6.7	11.2	7.7	.12	−1.00
13	24.7	27.0	32.0	27.9	1.6	.20
14	28.7	32.0	34.2	31.6	3.65	.56
15	7.4	9.5	9.5	8.8	.20	−.70
16	9.8	11.2	16.4	12.5	.32	−.48
17	14.8	16.7	22.0	17.8	.43	−.37
18	14.5	15.1	18.6	16.1	.70	−.16
19	13.2	15.5	15.0	14.6	.70	−.16
20	29.1	27.5	42.5	33.1	3.2	.506
21	19.9	18.8	28.5	21.7	1.04	.02
22	26.2	29.0	37.6	30.9	1.30	.13
23	24.0	25.8	29.7	26.5	1.30	.16
24	19.7	21.3	21.6	20.9	1.23	.12
25	19.6	21.6	20.1	20.4	1.45	.16
26	18.8	16.2	27.0	20.7	1.23	.12
27	19.3	17.4	29.2	21.0	1.45	.16
28	20.8	27.6	41.8	30.1	1.73	.08
29	26.8	23.1	39.8	29.9	2.04	.31
30	17.6	18.1	31.8	21.5	.99	−.65
31	22.5	23.2	33.7	26.5	.89	−.05
32	24.3	24.0	32.7	27.0	1.06	.03
33	26.7	25.9	37.6	30.1	.97	−.01
34	27.0	27.5	34.9	29.8	1.00	.03
35	20.3	30.9	43.9	31.7	1.31	.12
36	31.4	32.2	43.6	34.7	1.57	.20
37	29.1	26.9	39.4	31.8	1.28	.09
38	20.7	26.9	43.7	30.4	1.31	.12
39	26.0	24.5	29.4	26.6	1.30	.08
40	28.6	33.6	45.0	36.4	.97	−.01

28. Single sheet aluminum, ½-inch layer balsam wool covered on both sides with paper, 1-inch layer balsam wool covered on both sides with paper, second sheet aluminum.
29. Single sheet 0.025-inch aluminum, 2 layers 1-inch hair felt, second sheet aluminum.
30. Single sheet 0.025-inch aluminum, ½-inch layer balsam wool covered on both sides with paper, second sheet aluminum.
31. Single sheet 0.025-inch aluminum, one layer 2-inch dry zero blanket, second sheet aluminum.
32. Single sheet 0.025-inch aluminum, 2 layers 2-inch dry zero blanket, second sheet aluminum.
33. Single sheet 0.025-inch aluminum, one layer 2-inch dry zero blanket, one sheet 5/16-inch insulite.
34. Single sheet 0.025-inch aluminum, one layer 2-inch dry zero blanket, one sheet ¼-inch plywood.
35. Single sheet 0.025-inch aluminum, ½-inch layer balsam wool covered on both sides with paper, 1-inch layer balsam wool covered on both sides with paper, 5/16-inch sheet insulite.
36. Single sheet ⅛-inch plywood, ½-inch layer balsam wool covered on both sides with paper, 1-inch layer balsam wool covered on both sides with paper, ⅛-inch sheet plywood.
37. Single sheet ⅛-inch plywood, one layer 2-inch dry zero blanket, second sheet ⅛-inch plywood.
38. Single sheet 0.025-inch aluminum, ½-inch layer balsam wool with paper on both sides, single sheet 0.006-inch aluminum, 1-inch layer balsam wool with paper on both sides, sheet of 0.025-inch aluminum.
39. Single sheet 0.025-inch aluminum, four layers cotton approximately ¼ inch thick separated by sheets of wrapping paper, second sheet of aluminum.
40. This was a large panel 70 by 84 inches made of 1¾ by 1¾ inch stock. There were crosspieces running the shorter way approximately 16 inches apart. Sheets of aluminum 0.025 inch thick were fastened on one side of this frame. Two-inch dry zero blanket was cut up and placed in the spaces between the frame work. The opposite side was covered with sheets of 5/16-inch insulite.

Though airplane noises are intense and there is a limit to the additional weight that a plane may carry, it has been found that by a comparatively moderate increase in weight the sound intensity in an airplane cabin can be reduced to a degree where conversation can easily be maintained.

It should also be noted that the structure used was found to be an excellent heat insulator, and should make the cabin comfortable from the standpoint of temperature in even the coldest weather or at high altitudes.

Sound insulation installed during the construction of the plane, with care as to details, should give even better results than those obtained in the experiments described.

REGULATING AIRPORTS ENTRIES

Terms for Use of Facilities by Flyers Laid Down by Department of Commerce

REGULATIONS governing the designation and continuance of airports of entry of the United States as promulgated by the interdepartmental committee on airports of entry and approved by the Secretaries of Treasury, Commerce, and Labor are published in full below. Following the regulations is a list of airports that have received "permanent" and "temporary" designations as airports of entry by the committee.

AS USED in these regulations (a) The term "United States" when used in a geographical sense, means the territory comprising the several States, Territories, and possessions of the United States (except the Philippine Islands, the Virgin Islands, and the islands of Guam and Tutuila, and the District of Columbia, including the territorial waters thereof, and the overlying air space. (b) The term "aircraft" means "any contrivance now known or hereafter invented, used or designed for navigation of or flight in the air, except a parachute or other contrivance designed for such navigation but used primarily as safety equipment. (Sec. 9 (c), air commerce act of 1929) (c) The term "airman" means "any individual (including the person in command and any pilot, mechanic, or member of the crew) who engages in the navigation of aircraft while under way, and any individual who is in charge of the inspection, overhauling, or repairing of aircraft." (Sec. 9 (k), air commerce act of 1926.) (d) The term "airport" means "any locality either of water or land which is adapted for the landing and taking off of aircraft and which provide facilities for shelter, supply, and repair of aircraft or a place used regularly for receiving or discharging passengers or cargo by air." (Sec. 9 (g), air commerce act of 1926.) (e) The term "airport of entry" means an airport designated by the Secretary of the Treasury as a port of entry for civil aircraft.

The airports of the United States to be used as airports of entry will be designated by the Secretary of the Treasury, and by the Secretary of Labor as ports of entry for aliens arriving by aircraft; after due investigation to establish the fact that a sufficient need exists in any particular district or area to justify the designation of an airport of entry and to determine the airport best suited for the purpose.

A specific airport will be designated in each case rather than a general area or district which may include several airports.

The designation as an airport of entry may be withdrawn if it is found that the volume of business clearing through the port does not justify maintenance of inspection equipment and personnel, if proper facilities are not provided and maintained by the airport, if the rules and regulations of the Federal Government are not complied with, or if it be found that some other location would be more advantageous.

Airports designated as airports of entry shall, so far as practicable, be municipal airports and shall meet at least the requirements of the Airport Rating Regulations of the Department of Commerce for an A1A airport, unless particular conditions which prevail warrant a departure from these requirements. Additional requirements may be imposed as the needs of the district or area to be served by the airport may demand.

Airports of entry shall provide without cost to the Federal Government suitable office and other space for the exclusive use of Federal officials connected with the port.

A suitable surfaced loading area shall be provided by the airport at a covenient location with respect to and in full view of the above office space. Said loading area shall be reserved for the use of aircraft clearing through the airport.

All aircraft clearing through the port shall receive the required servicing by airport personnel, promptly and in the order of arrival or preparation for departure.

The charges made for such servicing and for the use of the airport by said aircraft shall be in accordance with published rates approved by the Department of Commerce and posted at the office space provided for the use of the Eederal Government.

Airports of entry shall, in each case, require that all civil airplanes and airmen of the United States using the airport be licensed by the Secretary of Commerce, and shall adopt and enforce the observance of the standard airport field rules prepared by the Department of Commerce.

THE list of "permanent" and "temporary" airports designated to date follows:

Ajo, Ariz., Ajo municipal airport.
Albany, N. Y., Albany municipal airport.
Brownsville, Tex., Brownsville municipal airport.
Buffalo, N. Y., Buffalo municipal airport.
Detroit, Mich., Grosse Ile airport.
Key West, Fla., Meacham airport.
Miami, Fla., Pan American airport.
Newark, N. J., Newark Metropolitan airport.
San Diego, Calif., Ryan airport.
San Juan, P. R., Escambron Field.
Seattle, Wash., Boeing Field.
Seattle, Wash., Lake Union (seaplane).
St. Paul, Minn., St. Paul airport.

TEMPORARY

Akron, Ohio, Akron municipal airport.
Alhambra, Calif., Western Air Express Terminal.
Derby, Vt., Canadian Gateway Airport.
Detroit, Mich., Ford Airport.
Douglas, Ariz., Douglas International Airport.
El Paso, Tex., El Paso municipal airport.
Los Angeles (Glendale), Calif., Grand Central Air Terminal.
Nogales, Ariz., Nogales municipal airport.
Palm Beach, Fla., Curtiss seaplane anchorage.
Pembina, N. Dak., Pembina municipal airport.
Portal, N. Dak., Portal municipal airport.
Port Angeles, Wash., Port Angeles airport.
San Juan, P. R., Isla Grande airport.

Air Depot Building

AN award of contracts to Morley Brothers Construction Co., of Kansas City, Mo., for the construction of a factory building at Fairfield Air Depot, Dayton, Ohio, has been authorized and announced by the War Department. The amount of the bid was $199,490, according to the statement, which follows in full text:

The Quartermaster General has authorized the Constructing Quartermaster, Wright Field, Ohio, to award contracts to Morley Brothers Construction Co., Kansas City, Mo., the lowest bidder, in the amount of $199,490, for the construction of a factory building at Fairfield Air Depot, Dayton, Ohio.

Change in Training

ANTI-AIRCRAFT regiments of Arkansas and Missouri will be trained at Fort Barrancas, Fla., in alternate years on account of unfavorable firing conditions at Fort Sill, Okla., the War Department has announced. The statement follows in full text:

On account of unfavorable firing conditions for anti-aircraft troops at Fort Sill, Okla., the anti-aircraft regiments of Arkansas and Missouri will be trained at Fort Barrancas, Fla., in alternate years, the other regiment training (without firing) at a point in its home station each year. The plan was inaugurated by sending the 203d Coast Artillery, AA., Missouri National Guard, to Fort Barrancas in 1929. The 206th Coast Artillery, AA., and the 154th Observation Squadron, Arkansas National Guard, are scheduled to train at Fort Barrancas in July, 1930. The cost of this plan is less than the cost of training these two regiments at Fort Sill, Okla., and most probably will be continued until a satiafactory training ground is developed in the middle west.

Where the 3-inch materiel can be made available, it is the policy to utilize the more efficient 3-inch gun in lieu of the 75-millimeter gun for anti-aircraft firing.

DEVELOPMENT OF AVIATION IN CZECHOSLOVAKIA

SINCE the war aviation has developed to a considerable extent in Czechoslovakia largely through the efforts and initiative of the government. The government has fostered the organization of aviation clubs. The 1929 budget for aviation, military and civilian, amounted to 96,182,660 crowns (approximately $2,828,901). This amount was divided approximately two-thirds for military and one-third for civilian aviation. Subsidies for air transport companies amounted to 11,850,000 crowns ($348,529). For propaganda 1,840,000 crowns ($54,117) was used. In 1924 there were established government-owned and controlled state air lines. This service, developed to provide a net work connecting the principal cities, and in 1927 the privately owned, but government subsidized, Czechoslovak Air Transport Company was established.

To foster aircraft production, high import duties and a system of licenses for imports for aircraft were inaugurated. There are seven principal firms in Czechoslovakia manufacturing airplanes and aircraft products. Among the material manufactured are airplanes of all types (some under foreign license) for transport services, scout and bombarding planes for military use, and sport planes, and motors of different types.

There are six aviation companies, two of which are Czechoslovak, two German, one French and one Polish operating in Czechoslovakia. The Czechoslovak State Air Lines, state-owned and operated, has a daily, except Sunday, passenger, goods and mail service between Prague-Brno-Bratislava-Kosice-Uzhorod and between Prague and Marienbad. This company has 20 planes in operation, employs 8 to 10 pilots and about 80 other persons. Most of the planes used are manufactured in Czechoslovakia under foreign license.

The Czechoslovak Air Transport Company operates a service on the Berlin-Dresden-Prague-Vienna line jointly with the Deutsche Luft Hansa and the Austrian Air Traffic Company. They also have a service over the Prague-Marienbad-Cassel-Rotterdam route. In 1929 a new line was opened from Marienbad to Nuremberg with a landing at Essen-Muhlheim on the Pargue-Rotterdam route. All their planes are equipped with heated cabins, lavatories, electric lighting and special compartments for luggage.

The Companie Internationale de Navigation Aerienne, "Cidna," maintains a schedule of six flights weekly during the Summer months and three weekly during the Winter, carrying both passengers and mail between Paris and Constantinople through Strasbourg, Nuremberg, Prague, Vienna, Budapest, Belgrade and Bucharest. Three flights a week are made between Belgrade and Constantinople. Daily flights, except Sunday, are made between Prague and Warsaw through Breslau. Other services conducted by this company are as follows: Daily flights for transportation of merchandise between Prague-Paris and Prague-Bucharest; three weekly flights between Prague-Warsaw, Belgrade-Sofia and Bucharest-Constantinople.

The German companies operating in Czechoslovakia are the Deutsche Luft Hansa and the Austrian Air Traffic Company, both of which operate jointly with the Czechoslovak Air Transport Company.

The service of three trips weekly between Lemberg-Cracow-Brno-Vienna is operated by a Polish company.

There are six principal airports in Czechoslovakia, situated at Prague, Brno, Marienbad, Bratislava, Kosice and Uzhorod. The one at Prague is the largest and best equipped. The following shows the total of air traffic of all companies operating through Prague in 1929: Flights, 5,091; passengers carried, 1,336; mail carried (kilos), 17,970; goods and baggage carried (kilos), 579,420.

Because of the protection given the aircraft production industry by the government almost all the needs of Czechoslovakia are supplied by that country. Some exporting, particularly in motors, is being done, the principal customers being in Yugoslavia, Finland and Poland. Imprts into Czechoslovakia have been negligible. Two complete planes, valued at 729,000 crowns ($21,411), and 10 airplane motors, valued at 1,583,000 crowns ($46,558) were imported in 1928. Most of these imports came from France. Airplane parts valued at 387,000 crowns ($11,382) were imported mainly from France and Germany.

Flying Salesmen

A NUMBER of firms are cultivating the market for their products in mining, lumber and construction camps in northern Canada by using airplanes. Many of these camps are otherwise inaccessible except by canoe and dog sled. Flights are made to most of the camps by various commercial operators of aircraft. Salesmen sometimes proceed to the end of the railway, and fly for the remainder of the distance. It is important, however, that salesmen visiting mining camps obtain a letter of introduction to the mine's superintendent from the head office of the company, since many mining companies resent intrusion by strangers. (A. H. Thiemann, Assistant Trade Commissioner, Ottawa, Canada, Feb. 13, 1930.)

Sports Flying

BOTH the Basel Air Traffic Company and the Aviatikbeider Basel have been keenly interested in the development of sports flying, and as the result of their activities seven airplanes have been added to the four large 3-motor "Fokker" planes that were in use. There are several privately owned airplanes in Basel that are used for business and pleasure, and as five new pilots' licenses were issued in 1929 to persons living in Basel, and three more are to be issued soon, the number of privately owned planes will undoubtedly increase during this year. (Calvin M. Hitch, Consul, Basel, Switzerland, Jan. 13, 1930.)

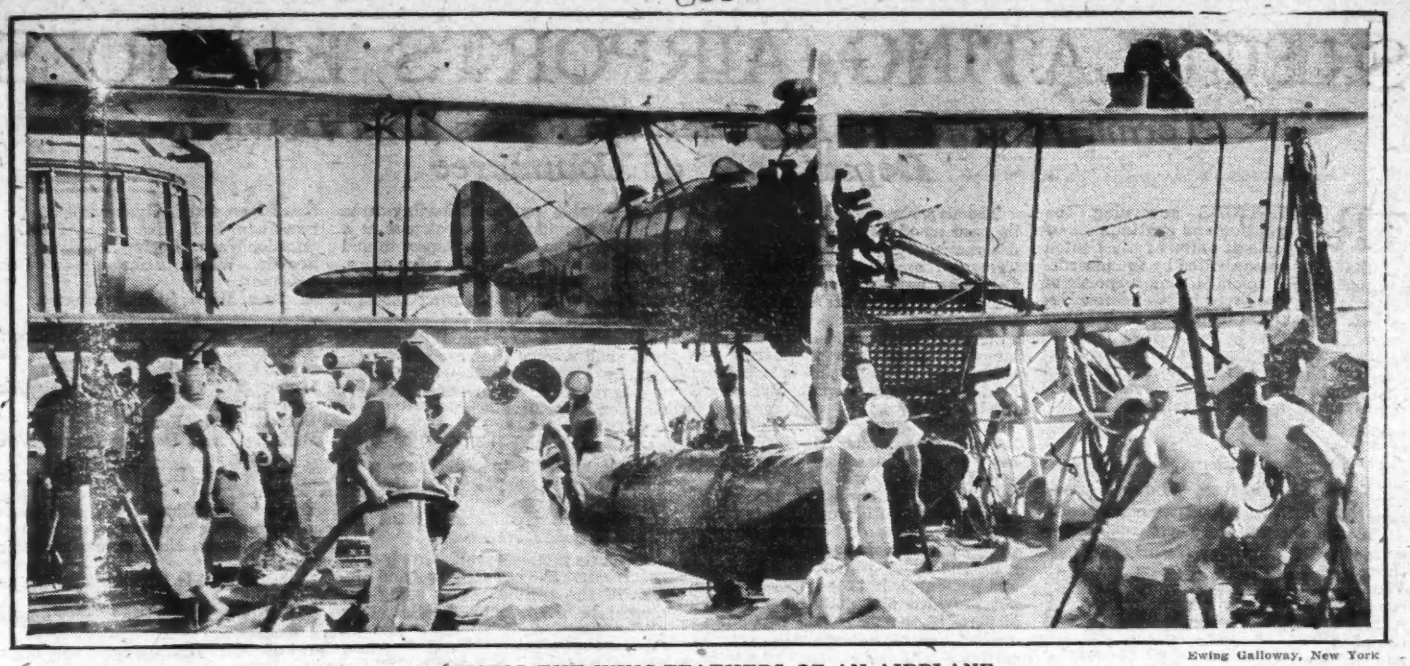
Contract for Planes

A CONTRACT for nine fighting planes has been let by the Navy Department to the Curtiss Aeroplane and Motor Co., of Garden City, Long Island, N. Y., according to a statement made by the Department Feb. 13. The planes will be for the use of the Marine Corps. The amount of the contract price is $117,562.50, according to the statement, which follows in full text:

The Navy Department has let a contract with the Curtiss Aeroplane and Motor Co., of Garden City, Long Island, N. Y., for nine fighting planes for the use of the Marine Corps. These planes will be known as the F8C-5 and are an adaptation of the Curtiss carrier type F8C-4 planes with the carrier features omitted. The F8C-5's just purchased will be two-seater biplanes equipped with the Pratt and Whitney "Wasp" engine. The contract price for these planes is $117,562.50.

Surveying Capetown

THE City Council and the Divisional Council have each contributed £5,000 for a survey to be made shortly, which is to cover Capetown and its suburbs. Several sets of specifications are being drawn up and, when these have been completed, the survey will be let out to tender. It is not expected that any action will be taken regarding the calling of tenders until after the first of April. (DuWayne G. Clark, Assistant Trade Commissioner, Johannesburg, South Africa, Jan. 15, 1930.)



Ewing Galloway, New York

PREENING THE WING-FEATHERS OF AN AIRPLANE

When an Airplane Joins the Navy It Becomes the Object of Traditional Cleanliness. This Photograph Shows Sailors at Work on Airplane Forming Part of Equipment of the U. S. S. "Texas."

AVIATION STUDY IN NEW JERSEY

Report of Commission Covers Subject of Control Over Aeronautics in The State and Outlines Proposed Legislation

ESTABLISHMENT of State control over aviation is proposed in a report to the New Jersey Legislature by the commission created last year to study the subject and recommend a code of laws.

The commission asks that it be vested with the necessary power to exercise such control. In addition, an appropriation of $2,500 is suggested to cover expenses for the balance of the current fiscal year and $5,000 for next year.

"The commission should be vested with absolute authority over pilots and airports in this State," says the report. "The Department of Commerce has a certain amount of authority, but it covers the entire United States and naturally does not have the machinery to handle a subject expanding as speedily as aviation.

"Your commission should have the power to suspend flying privileges in this State by grounding pilots and ships that are unsafe. Your commission should have power to subpoena witnesses for hearing."

A bill pending in the legislature would vest the State board of commerce and navigation with power to regulate aviation.

As to the adoption of legislation in harmony with Federal acts and the laws of other States, which was the primary purpose of the commission's creation, it is suggested that action be deferred until it is determined by further conferences the measures that are desirable.

Two proposed acts, one drawn by the United States Department of Commerce and the other by the American Bar Association, are under consideration, continued the report.

"There are some variations between the act promulgated by the American Bar Association and the act of the Department of Commerce, so that at this time until these two national organizations agree on a unform act it does not seem wise that this State should hurry the matter."

The full text of the report follows:

In compliance with Joint Resolution No. 21, Laws of 1929, the State Aviation Commission herewith respectfully submit its first report of activities from the date of inception throughout the balance of calendar year 1929.

The commission effected an organization shortly after the governor had made the appointments of same, which was on or about July 8, 1929.

Its members are E. L. Chalmers, chairman; G. Noyes Slayton, vice chairman; Willard E. Bowman, secretary; William G. Williams and John F. Casey.

The activities of the Commission have been wide in scope and have covered practically every subject at one time or another, concerning aviation and any matter incidental thereto. Persons vitally connected with aviation have expressed appreciation of an aviation commission and have expressed their desire that a State agency of this character is urgently needed. Also that a commission of this character will be of great value to the State and its citizens toward increasing agencies of transportation by air and toward making said transportation a safer method of travel.

A commission of this kind can do much toward promotion of airports and suggests regulations pertaining to same. The Commission has aimed to establish and maintain cordial relationship with operators and managers of airports and air service in this State. The Commission has had the cooperation of present State agencies in order to help facilitate their work and appreciate offers made by the State board of commerce and navigation and other official bodies.

A brief resume of the Commission's work follows:

Prof. Harry J. Freeman, of New York University, cooperated with the Commission and supplied copies of a uniform act for the regulation of aeronautics as promulgated by the Department of Commerce and an act promulgated by the American Bar Association. Both of these acts have been read and digested by your Commission. A collection of State aviation laws from various States have been collected and digested. All the laws of the Department of Commerce have been obtained and studied concerning every branch of aviation. A few of which are: Airport management, civil aeronautics in the United States, airport lighting, airport regulations, air travel rules, designing of airports, study of meteorology, weather conditions, air commerce regulations, licensing of pilots and other matters.

There are some variations between the act promulgated by the American Bar Association and the act of the Department of Commerce, so that at this time until these two national organizations agree on a uniform act it does not seem wise that this State should hurry the matter. Because of the speed of an aeroplane and great distances covered, it is the opinion of your Commission, laws concerning aviation and airports should be uniform. The Commission, through the backing of Governor Larson, has promised to cooperate with Harry Schwartzchild, publisher of Airport Magazine, in representing the great State of New Jersey at a national conference, out of which is hoped a uniform act will emerge suitable to all the States of the Union.

Your Commission has had a number of meetings. It has officially opened three airports, attended air races at various airports in the State and done everything possible to obtain a working knowledge of aviation and with the idea of learning what is needed by the airports and aviators. Your Commission is composed of men peculiarly adapted to the carrying out of this work; an ex-Navy pilot and officer that has had a number of hours of practical flying and a thorough course of instruction by the United States Navy. A commercial operator who owns and operates an airport and is considered one of the best flyers in this State. A lawyer that has made aviation law his particular hobby. A veteran automobile racer that knows the idiosyncrasies of pilots and has a thorough knowledge of motors. A newspaper editor of one of the largest New Jersey newspapers that is collecting valuable aviation data and has a knack of getting to the bottom of any question concerned. These men are serving without compensation. They are doing it for the love of aviation, and with a hope that they are doing a service for their State. None of these men are wealthy men and yet you cannot travel about the State, attend conferences, visit airports, inspect ships, attend conferences in Washington, New York and Chicago and carry on correspondence without the expenditure of considerable money. Each commission has had considerable correspondence in carrying out his particular type of work. There should be a sum of money available to pay the expense of this work.

The commission should be vested with absolute authority over pilots and airports in this State. The Department of Commerce has a certain amount of authority, it covers the entire United States and naturally does not have machinery to handle a subject expanding as speedily as aviation. Your commission should have the power to suspend flying privileges in this State by grounding pilots and ships that are unsafe. Your commission should have power to subpoena witnesses for hearing. Your commission asks that the amount of $2,500 be included in the supplemental budget to take care of the commission's activities until commencement of the State's fiscal year and that $5,000 be appropriated for the fiscal years 1930 and 1931. The expenditure of $5,000 be as follows: Secretary's salary, $600; materials and supplies, $650; miscellaneous expenses, such as travel, opening airports, inspections, expense in maintaining secretary's office, hearings, etc., $3,250, which are necessary in order that the ideas of the legislature be carried out on this important subject.

PROBLEMS OF PENNSYLVANIA

AIRPORT operators, pilots and other Pennsylvanians interested in aviation will be asked to a conference with the State aeronautics commission of Pennsylvania on Wednesday, Mar. 20, it was announced Mar. 7 by James F. Woodward, secretary of internal affairs and chairman of the aeronautics commission.

The gathering, which will be held in the caucus room of the House of Representatives, Capitol Building, Harrisburg, will open at 10:30 o'clock in the morning and continue throughout the day. Representative men from Pittsburgh, Philadelphia and other places where aviation operations are carried on on a large scale have advised the commission of their intention to come to Harrisburg for the meeting. Many of the leading pilots and representatives of aviation schools also are expected.

Aviation in all its phases will be open for discussion and the delegates will be asked to offer suggestions as to the most effective means of promoting and fostering flying within the Commonwealth. Weather permitting it is expected that a number of the visitors will come to Harrisburg by plane.

A total of 27 airports and landing fields which made application to the aeronautics commission have been granted licenses either to carry passengers or instruct students in flight. Other applications are pending and will be acted on by the commission when the State inspectors have checked over the fields, maps and drawings which are required to accompany all such application.

The commission has decreed that fields not making applications for license will be refused permission to operate and the State's aviation inspectors have been instructed to give such notice to operators.

On Feb. 28 a total of 1,669 licenses had been issued by the commission to various aviation activities in Pennsylvania, as follows: Pilots of all classes, 475; mechanics, both airplane and engine, 308; airplanes, 425; student pilot permits, 461. It is believed that when the flying season is well under way that these figures will be materially increased in all the classes.

With a view to protecting Pennsylvania operators who have invested their funds in opening fields, purchasing planes and employing pilots and mechanics, the commission will, this season, check closely on outside interests coming into State, squatting on a convenient field and carrying passengers for hire.

STUDY OF SAFETY IN AVIATION

Wind-tunnel Experiments Conducted by Bureau of Standards As Tests of Equipment Efficiency

THE engineering development of the airplane into a reasonably efficient and speedy vehicle for the transportation of freight and passengers has progressed to such a stage that the focus of interest has shifted from performance as measured by pay loads and cruising speeds to questions of safety and reduced costs. This declaration is contained in a statement issued by the Aeronautics Branch of the Department of Commerce, the full text of which proceeds as follows:

The ultimate purpose of all of the activities of the Aeronautics Branch of the Department of Commerce is to insure, so far as possible, the safety of airplane, pilot, passengers, mail, express, and the general public. In the words of Assistant Secretary Young, it is to assist in creating a combination of four elements: (1) Airworthy aircraft adequately equipped and efficiently maintained, and (2) flown by competent pilots over (3) suitably equipped airways, (4) in conformity with standard air-traffic rules.

As a part of item (1) of this general program, the Aeronautics Branch through its research division in the Bureau of Standards has carried out certain wind-tunnel studies of the lateral control of airplanes in relation to safety.

IT IS generally known that an airplane pilot needs to be able to steer his craft in three ways. In addition to a rudder to turn the nose of the airplane to the right or the left, he needs an elevator to raise or lower the nose, and in addition some method of raising or lowering the wing tips; that is, rolling the machine about its longitudinal axis. This last control, namely, the lateral control, is commonly effected by the use of ailerons, the technical name for two hinged flaps, one at each wing tip, which are usually interconnected so that when one is turned down the other is turned up.

The ailerons are controlled by the side-to-side motion of the control stick. If the right wing is lowered by a gust of wind, the flap on the tip of the right wing is turned down and the rush of air striking it tends to raise the right wing. Simultaneously the flap at the tip of the left wing is turned up to depress the left wing. It is found by experiment that the forces produced are much greater than those that would be produced on a surface of the area of the flap and that the movement of the flap alters the force on the whole tip of the wing.

The perfect lateral control would be one which rolled the machine and did nothing else, no matter what the attitude of the machine. Unfortunately the simple ailerons are far from perfect. Their defects may be briefly outlined as follows:

In the first place, as the forward speed of the airplane is decreased, the rolling effect produced falls off very rapidly, much more rapidly than would be caused by the decrease in speed alone. The trouble is caused by the wing reaching the stalling angle, or angle at which the lift reaches its maximum value, so that turning the aileron down no longer increases the lift but may actually decrease it so that the low wing is depressed still farther. In the early days of aviation, ignorance of this fact was responsible for many accidents and in the early experience of beginners is still a source of trouble. The motion of the stick which is corrective under ordinary conditions aggravates the trouble at the stalling point.

CONVENTIONAL ailerons are subject to a second difficulty. The motion of the ailerons not only alters the lifting force of the wing tips but also alters the drag or resistance to motion. If both tips were equally affected no great harm would be done but under ordinary conditions the downward aileron has the greatest drag. The result is that the application of the ailerons to lift a low right wing gives a greater drag on the low wing holding it back and turning the machine to the right. The turning makes the high wing move faster which as a secondary effect increases the lift on the high wing tending to lift it still higher. This effect becomes more and more pronounced as the stalling angle is approached and constitutes a hazard in addition to that previously described. The inexperienced pilot trying to fly at a very low speed approaches the stalling angle, a wind gust lowers one wing, the natural and usual corrective motion of the control stick sends the low wing still lower, pivots the machine about the low wing, and sends the machine into a spin.

THE knowledge of these defects of the standard aileron control has been available for many years and every effort has been made to devise a more satisfactory method. Improved methods have been developed, the most satisfactory being the combined slot-and-aileron control developed in England. Research is still in progress, in this country by the National Advisory Committee for Aeronautics, on new and unusual types of lateral control in search for something still better.

A majority of airplanes submitted to the Aeronautics Branch for approval make use of the conventional control. The importance of a full study of the conventional control is therefore self-evident. Especially is it important to ascertain whether the safety of the airplane can be increased to a moderate extent by inexpensive modifications of the standard type or by a suitable choice of shape and size of aileron. The region of particular interest is that near and above the stalling point.

The purpose of the experiments at the Bureau of Standards was to study this field of the conventional aileron at large angles of attack. The program correlates with the investigation of new types of control by the National Advisory Committee for Aeronautics and in fact the details are reported to the aerodynamics committee of the National Advisory Committee. Through the cooperation of the committee the results are published as technical reports of the committee, thus making the information available to the design staffs of the commercial companies in a most accessible place. One report has been issued (Technical Report 298), one is in press, and a third is in preparation.

THE measurements were carried out on a model of 5-foot span and 10-inch chord in the 10-foot wind tunnel of the Bureau of Standards at wind speeds up to 80 feet per second. The model was therefore larger than those previously used for aileron measurements and the effect of scale correspondingly less. Seven ailerons, varying in width (chord) and length (span) were used on two commonly used wing sections (U. S. A. 27 and Clark X). The angle of attack of the wing was varied from 4 degrees to 16 degrees in all cases and for two of the ailerons to 40 degrees.

For a given aileron set at a given angle on a particular wing at a fixed angle of attack, three quantities need to be measured, namely the effect in rolling the machine or the rolling moment, the effect in turning the machine to the right or left or the yawing moment, and finally a quantity termed the hinge moment. This last quantity is a measure of the force which the pilot must apply with a definite leverage to hold the aileron in position. Obviously if this force is too great the pilot can not secure the measured rolling moments. Each of the three quantities is a function of the wing section used, the aileron size and shape, the aileron angle, the angle of attack of the wing, and the wind speed. As is usual in airplane problems, the selection of an aileron size, angular travel, and leverage ratio for the control stick is a matter of compromise and the results of the tests can not be reduced to a single formula or general statement.

IN GENERAL the upward motion of the aileron produces a greater rolling moment and a smaller yawing moment than the downward motion. For a considerable range of angular travel the direction of the yawing moment corresponds to a reduction in drag and is such as to produce a rolling moment due to yaw opposing the rolling moment due to the aileron setting. With a large aileron travel, however, the yawing moment becomes such as to help the aileron, the high wing having increased drag. In all cases the yawing moments produced by upward travel are much less than those produced by the conventional combination. Very definite aerodynamic advantages are indicated for the use of upward travel alone; that is, the use of a cam or other mechanical device which would retain the normal down-moving aileron in the neutral position while displacing the other aileron upward. In practice, it would prove simpler to use a differential motion of the two with as large a ratio of up movement to down movement as mechanically possible. There are some disadvantages, since the rolling moment produced by upward travel alone is not as great as that produced by the normal combination. (The contribution of the down aileron is less than that of the up aileron, but the sum is greater than either.) A compromise in the way of larger ailerons, greater travel or possibly both is necessary. It is believed that the matter is worthy of further study on full scale airplanes in the direction of better control of low speeds.

The results show the very great decrease in effectiveness of the aileron as the stalling angle is reached and indicate in general that an aileron of given size is somewhat more effective on the U. S. A. 27 section than on the Clark Y. The rolling moment produced is somewhat greater and the yawing moment somewhat less on the U. S. A. 27 section.

IN ADDITION to the problem of adequate control at the stalling angle, measurements of the aerodynamic properties of ailerons have another bearing on the general problem of safety. The aerodynamic loads which may be imposed on an airplane depend in large measure on the power of the controls. An airplane with a powerful aileron control can be rolled more rapidly and greater loads may be imposed than on an airplane with a weaker control in relation to its inertia and other characteristics. The results of the wind-tunnel measurements can be used in conjunction with drawings of the airplane to compare the maximum rolling moments which can be imposed by the ailerons.

The problem of improving the safety of airplanes is one of great complexity. It has received the attention of many investigators over a period of years and the Aeronautics Branch does not expect to be able to indicate a complete solution as a result of a few wind-tunnel measurements. In fact the attention of the Aeronautics Branch in the present measurements has been directed to a study and exposition of the peculiarities of the control which is now in general use and which will probably remain in general use for many years, rather than to a study of new devices. If attention can be drawn to its defects, and methods of improvement can be indicated, the purpose of the study will have been attained.

REGISTRATION FOR GLIDERS AS SAFETY CERTIFICATE

ALTHOUGH applications have been made to the Aeronautics Branch of the Department of Commerce for identification marks for 110 gliders, no formal requests have been received for glider licenses or for glider approved-type certificates, according to a statement issued by the Bureau. The full text of the statement proceeds:

An unlicensed glider may or may not be safe. The fact that it possesses an unlicensed identification number does not in any manner testify to the airworthiness of the craft. Beyond serving to identify the craft's ownership either in flight or on the ground, the identification number means nothing else.

A LICENSE number (which is preceded by the letter "C") means that the craft has complied with certain standards and requirements of the Department of Commerce and therefore may be regarded as possessing the Government's stamp of approval as to airworthiness.

The Aeronautics Branch of the Department of Commerce is in possession of adequate machinery to license gliders as to airworthiness. Gliders do not have to be licensed unless they engage in interstate commerce, and as gliding and soaring are more of a scientific sport than a commercial venture, it is not likely that the Aeronautics Branch will find any violations of the air commerce act requiring the licensing of all aircraft engaging in interstate commerce.

However, there are 20 States and Territories which require Federal licenses for all aircraft and airmen, and as gliders and glider pilots are classed as aircraft and airmen, unlicensed gliders and unlicensed glider pilots operating in those 20 States are violating the State law and are subject to penalty. The Territory and States which require Federal licenses are as follows: Alaska, Arizona, California, Delaware, Idaho, Indiana, Iowa, Michigan, Mississippi, Missouri (except solo pleasure), Montana, New Mexico, North Dakota (by order of board of railway commissioners), Rhode Island, South Dakota, Texas, Vermont, Washington, Wisconsin, Wyoming.

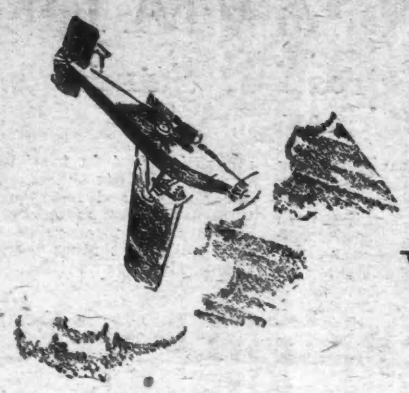
The general airworthiness requirements for airplanes with power plant are applicable to gliders. Certain aspects of the glider problem differ materially from those encountered in powered craft and must be given special consideration. These are the design loads for wings, fuselages, landing gears, control surfaces, and control systems; the material and method used for covering surfaces; the provision for towing; the equipment and instruments to be provided and the method of conducting the engineering inspection and flight tests.

With regard to flight tests there are no quantitative performance requirements for gliders. Qualitatively, it is required that, under all load conditions, they be longitudinally balanced and longitudinally, laterally, and directionally stable. They must also exhibit no undue tendency toward falling off into a spin. Any tendency toward wing flutter will be cause for disapproval.

Aircraft in which no air controls are provided and shifting of the pilot's weight constitutes the sole means of adjusting the angle of attack and obtaining lateral balance, are not considered safe and will not be approved by the Department of Commerce. An efficient longitudinal air control is required. The lateral and directional control may be obtained by weight shifting providing that the stability of the aircraft is such that it will respond properly to such shifting of weight, as determined by actual flight tests, and providing that the pilot may recover his normal position from any other position in any attitude which the aircraft may assume.

TOWING of gliders may be practiced by man power, automotive power—such as automobiles and speed boats, or by an airplane. In all cases except when man power alone is used, an approved device shall be used for cutting loose the towing cable at the will of the pilot in the light aircraft. In order to eliminate the chance of failure of the main supporting structure due to excessive tow-cable pull, the strength of the tow cable shall not exceed two-thirds of the maximum wing structure design load.

The Department of Commerce desires to encourage "Young America" in glider flying, but hastens to point out that airworthy gliders should be used and the prospective glider pilot should have adequate instruction from a competent instructor.



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